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ABSTRACT

The United States Training and Employment Service General Aptitude Test Battery (GATB), first published in 1947, has been included in a continuing program of research to validate the tests against success in many different occupations. The GATB consists of 12 tests which measure nine aptitudes: General Learning Ability; Verbal Aptitude; Numerical Aptitude; Spatial Aptitude; Form Perception; Clerical Perception; Motor Coordination; Finger Dexterity; and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, and a standard deviation of 20. Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, when combined, predict job performance. Cutting scores are set only for those aptitudes which aid in predicting the performance of the job duties of the experimental sample. The GATB norms described are appropriate only for jobs with content similar to that shown in the job description presented in this report. A description of the validation sample is included. (AG)

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United States Training and Employment Service Technical Report March 1966

S-356 S-362 thru S-368

ED 072056

Development of USTES Aptitude Test Batteries

for

Various Occupations in the Iron and Steel Industry

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U.S. DEPARTMENT OF LABOR

MANPOWER ADMINISTRATION

1

Technical Report on Development of USTES Aptitude Test Batteries

For .....

Various Occupations in the Iron and Steel Industry

S-356 and S-362 through S-368

(Developed in Cooperation with
Pennsylvania State Employment Service)

March 1966

Battery and GATB Study Number	Occupation	Sample Code*	3rd Edition DOT Code	GATB Aptitudes and Minimum Acceptable GATB Scores						
				G	N	P	Q	K	F	M
S-356 #2572	Second Helper-Open Hearth	A	512.884			95		80		90
S- 362 #2576	Billet Yard Jobs	B								
	Pickler		503.885							
	Scarfer		816.884							
	Chipper		705.884			105				95
S-363 #2577	Maintenance Man, Factory or Mill	C	899.281	105	90					90
S-364 #2578	General Labor Worker	D	899.887			95			75	85
S-365 #2580	Ingot Mold Foundry Jobs	E								
	Hand Rammer		518.381							
	Sand-Slinger Operator		518.883							
	Knockoutman		519.887			90		85		100
S-366 #2581	Molder, Bench		518.381							
	Molder, Floor	F	518.381		90	100				85
S-367 #2595	Rolling Mills Jobs	G								
	Guide Setter		613.381							
	Manipulator		613.782							
	Screwdown Operator		613.782			95		80		105
S-368 #2596	Structural-Shipping Yard Jobs	H								
	Electric-Bridge-Crane Operator		921.883							
	Slipmaker		619.387							
	Gag-Press Straightener		617.782							
	Gasoline-Truck Operator		922.883							
	Crane Follower		892.883		90		100			95

* Used to identify samples in Tables 2-5

DEVELOPMENT OF USTES APTITUDE TEST BATTERIES

For

Various Occupations in the Iron and Steel Industry

This report describes research undertaken for the purpose of developing General Aptitude Test Battery (GATB) norms for various occupations in the iron and steel industry. The eight samples were analyzed separately. Two occupational samples were each divided into two subsamples in order to provide cross-validation data. The norms shown on the previous page were established on GATB Aptitudes for the various occupations.

RESEARCH SUMMARY

Sample:

1735 male applicants eventually employed at the Bethlehem Steel Company, Bethlehem, Pennsylvania.

Criterion:

Supervisory ratings

Design:

Longitudinal (test and criterion data were collected approximately one year apart).

Minimum aptitude requirements were determined on the basis of a job analysis and statistical analyses of aptitude mean scores, standard deviations, aptitude-criterion correlations and selective efficiencies for each of the occupations studied.

Predictive Validity:

Phi Coefficients ranged from .21 to .83 (P/2 from .05 to .0005)

Effectiveness of Norms:

Only 65% to 76% of the non-test selected workers used in this study were good workers; if the workers had been test selected with the above norms, 77% to 92% respectively would have been good workers. 24% to 35% of the non-test selected workers used in this study were poor workers; if the workers had been test selected with the above norms, only 8% to 23% would have been poor workers. The effectiveness of the norms is shown graphically in Table 1:

TABLE 1

Effectiveness of Norms

	Workers	Without Tests	With Tests	Phi
Second Helper-Open Hearth	Good	76%	89%	
	Poor	24%	11%	.43
Billet Yard Jobs	Good	68%	87%	
	Poor	32%	13%	.45
Maintenance Man, Factory or Mill	Good	68%	92%	
	Poor	32%	8%	.83
General Labor Worker	Good	69%	86%	
	Poor	31%	14%	.61

	Workers		Without Tests	With Tests	Phi
Ingot Mold Foundry Jobs	Good	Validation	70%	77%	
	Poor		30%	23%	.21
	Good	Cross-	70%	78%	
	Poor	Validation	30%	22%	.24
Molder, Bench Molder, Floor	Good		65%	81%	
	Poor		35%	19%	.50
Rolling Mills Jobs	Good		66%	80%	
	Poor		34%	20%	.40
Structural-Shipping Yard Jobs	Good	Validation	66%	77%	
	Poor		34%	23%	.33
	Good	Cross-	66%	78%	
	Poor	Validation	34%	22%	.31

SAMPLE DESCRIPTION

Size: A total sample of 1735 applicants eventually employed by the company were tested. The samples for each of the eight occupational areas ranged from N = 53 to N = 168.

Occupational Status: Applicants

Work Setting: Applicants were eventually employed at the Bethlehem Steel Company, Bethlehem, Pennsylvania.

Employer Selection Requirements:

Education: No requirement

Previous Experience: No requirement

Tests: No requirement

Other: All applicants were hired who could pass the physical examination and had no criminal record.

Principal Activities: Workers in the sample were selected from a labor pool for work within a specific department of the steel plant. Each worker has a specific job title in accordance with job progression sequences established by labor-management contracts, but performs many of the general functions of the department. Workers are expected to reach a "middle level" within the job sequence for each of the occupations.

Minimum Experience: All workers in the sample were inexperienced when tested.

TABLE 2 (A - H)

Means, Standard Deviations (SD), Ranges, and Biserial Correlations with the Criterion (r_{bis}) for Age and Education

			N	Mean	SD	Range	r_{bis}
A	Second Helper-Open Hearth						
	Age (years)			23.7	4.6	18-39	-.291
	Education (years)		55	11.1	1.3	8-13	-.016
B	Billet Yard Jobs						
	Age (years)			21.6	2.0	19-26	-.088
	Education (years)		80	11.7	0.9	9-14	.199
C	Maintenance Man, Factory or Mill						
	Age (years)			28.0	7.4	19-51	.243
	Education (years)		53	11.6	1.0	9-15	-.074
D	General Labor Worker						
	Age (years)			23.9	6.0	19-49	-.086
	Education (years)		61	11.1	1.2	9-13	.308
E	Ingot Mold Foundry Jobs						
	Age (years)	Validation	71	23.9	4.9	19-46	.261
	Education (years)	Sample		11.4	1.2	9-14	-.019
	Age (years)	Cross-Vali-	73	25.5	6.4	19-51	-.044
	Education (years)	dation Sample		11.3	1.3	9-14	.010
F	Molder, Bench Molder, Floor						
	Age (years)			24.2	4.6	19-31	-.488*
	Education (years)		54	11.5	1.2	10-15	.520*
G	Rolling Mills Jobs						
	Age (years)			25.6	5.9	19-43	.127
	Education (years)		70	11.5	1.2	9-16	.106
H	Structural-Shipping Yard Jobs						
	Age (years)	Validation		22.4	2.4	19-30	.200
	Education (years)	Sample	82	11.7	1.1	9-16	.084
	Age (years)	Cross-Vali-		22.2	2.3	19-27	.080
	Education (years)	dation Sample	86	11.7	1.0	9-15	-.041

* Significant (Correlation more than twice the standard error.)

EXPERIMENTAL TEST BATTERY

All 12 tests of the GATB, B-1002B were administered from June to October 1964 to all applicants referred to the Bethlehem plant of Bethlehem Steel by the Pennsylvania State Employment Service.

CRITERION

The criterion data consisted of supervisory ratings of job proficiency collected approximately one year after the testing date. The supervisors rated workers into one of two broad categories, good or poor, based on the individual's performance in the job or job area in which he was placed.

Reliability: Since only one rating was obtained, no measure of criterion reliability is available.

Criterion Dichotomy: The broad category ratings placed from 24% to 35% of the various samples in the low groups which correspond with the percentage of workers in the various occupations considered unsatisfactory or marginal by the rating supervisors. Workers in the high criterion group were designated as "good workers" and those in the low group as "poor workers."

APTITUDES CONSIDERED FOR INCLUSION IN THE NORMS

Aptitudes were selected for tryout in the norms on the basis of a qualitative analysis of job duties involved and a statistical analysis of test and criterion data. For Ingot Mold Foundry Jobs and Structural-Shipping Yard Jobs, the sample size permitted random division of the samples into (1) validation and (2) cross-validation subsamples. Tables 3, 4, and 5 (A-H) show the results of the qualitative and statistical analyses.

TABLE 3 (A-H)
Qualitative Analysis

A. SECOND HELPER-OPEN HEARTH

Aptitude	Rationale
G - General Learning Ability	Makes judgments in the production of steel.
N - Numerical Aptitude	Makes arithmetic calculations.

S - Spatial Aptitude	Perceives distances when operating open hearth furnaces and auxiliary equipment.
P - Form Perception	Weighs furnace alloys and checks temperature gauges.
K - Motor Coordination	Uses tools such as shovels, trowels and tongs.
M - Manual Dexterity	Operates equipment and uses hand tools.

B. BILLET YARD JOBS

Aptitude	Rationale
S - Spatial Aptitude	Necessary to identify pieces of steel on printed form and to designate pieces in acid bath using chain sling.
P - Form Perception	Necessary to remove surface defects from steel products.
K - Motor Coordination	Necessary in the quick and accurate use of hand tools.
M - Manual Dexterity	Necessary for operating oxygen-acetylene torch and pneumatic air hammer.

C. MAINTENANCE MAN, FACTORY OR MILL

Aptitude	Rationale
G - General Learning Ability	Makes judgments at the highest craft level in providing repair service for machinery and equipment.
S - Spatial Aptitude	Interprets drawings of motors, generators and switchboards.
P - Form Perception	Perceives details of electrical equipment.

K - Motor Coordination	Uses hand tools such as hammers, screwdrivers and burning torches.
F - Finger Dexterity	Repairs wiring and replaces faulty equipment.
M - Manual Dexterity	Installs, maintains and repairs electrical and mechanical equipment.

D. GENERAL LABOR WORKER

Aptitude	Rationale
S - Spatial Aptitude	Performs crane hooking to load and unload materials.
P - Form Perception	Strips forms from concrete foundations.
K - Motor Coordination	Necessary in cleaning and scraping roofs using broom, shovel, scrapper, pneumatic chip and other hand tools.
M - Manual Dexterity	Necessary in using powered hand tools, pouring and mixing concrete, cleaning sumps and valve pits with shovels, excavating foundations, and loading and unloading cars and trucks.

E. INGOT MOLD FOUNDRY JOBS

Aptitude	Rationale
G - General Learning Ability	Makes judgments in the production of ingot molds for use in other departments.
N - Numerical Aptitude	Necessary in regulating the travel of sandslinging machine, height of impeller head and volume of sand.
P - Form Perception	Selects proper pattern and observes ramming effects in core or mold.
K - Motor Coordination	Necessary in the quick and accurate use of machines and tools.
M - Manual Dexterity	Necessary in operating sand slinging machine and hand tools.

F. MOLDER, BENCH AND MOLDER, FLOOR

Aptitude	Rationale
G - General Learning Ability	Determines proper procedures in preparing castings for a wide diversity of items.
S - Spatial Aptitude	Checks and inspects print and pattern to determine molding requirements.
P - Form Perception	Perceives detail in mold ranging in size from very small to extremely large.
K - Motor Coordination	Necessary in placing cores and closing molds using hand tools to tighten nuts and bolts, and drive wedges.
M - Manual Dexterity	Operates pneumatic rammer, shovels sand, lays bricks, places necessary reinforcements in position and closes mold.

G. ROLLING MILLS JOBS

Aptitude	Rationale
G - General Learning Ability	Makes judgments in operating rolling machines.
S - Spatial Aptitude	Turns and aligns material for entry into the roll passes.
P - Form Perception	Observes material during rolling process and adjusts guides to produce a product meeting specifications.
K - Motor Coordination	Necessary in dismantling, assembling, and installing mill guides on various mill stands.
M - Manual Dexterity	Necessary to operate rolling machines.

H. STRUCTURAL-SHIPPING YARD JOBS

Aptitude	Rationale
G - General Learning Ability	Makes judgments in operation of electric-bridge crane.
N - Numerical Aptitude	Necessary in measuring structural material.
S - Spatial Aptitude	Necessary in the operation of electric-bridge crane to load structural steel on motor trucks and to pile and transfer structural material within the yard.
P - Form Perception	Perceives proper tolerance of structural steel sections using a vertical gag press.
Q - Clerical Perception	Locates material as indicated on order sheets.
K - Motor Coordination	Necessary in operation of electric-bridge crane, carrier and structural steel machines.
M - Manual Dexterity	Necessary in the operation of machines to load and assemble structural steel bars.

TABLE 4 (A-H)

Means, Standard Deviations (SD), Ranges and Biserial Correlations with the Criterion (r_{bis}) for the Aptitudes of the GATB

A. SECOND HELPER-OPEN HEARTH N = 55

Aptitude	Mean	SD	Range	r_{bis}
G - General Learning Ability	102.6	12.6	75-133	.274
V - Verbal Aptitude	98.3	12.3	78-137	-.029
N - Numerical Aptitude	102.5	13.0	78-132	.283
S - Spatial Aptitude	103.9	15.9	71-156	.303
P - Form Perception	104.9	11.2	75-134	.508*
Q - Clerical Perception	102.4	12.8	77-148	.309
K - Motor Coordination	105.4	16.5	74-146	.077
F - Finger Dexterity	95.5	18.1	56-136	-.106
M - Manual Dexterity	110.5	19.0	55-156	.199

B. BILLET YARD JOBS N = 80

Aptitude	Mean	SD	Range	r_{bis}
G - General Learning Ability	106.8	10.7	79-134	.414*
V - Verbal Aptitude	98.4	11.7	74-135	.255
N - Numerical Aptitude	109.3	11.8	72-136	.386*
S - Spatial Aptitude	108.7	16.3	65-143	.344*
P - Form Perception	111.6	13.1	72-145	.620*
Q - Clerical Perception	106.9	11.3	76-135	.437*
K - Motor Coordination	111.3	13.9	78-149	.344*
F - Finger Dexterity	99.4	17.3	64-145	.250
M - Manual Dexterity	118.5	19.5	76-156	.372*

C. MAINTENANCE MAN, FACTORY OR MILL N = 53

Aptitude	Mean	SD	Range	r_{bis}
G - General Learning Ability	113.3	11.2	77-133	.753*
V - Verbal Aptitude	107.2	13.5	60-147	.495*
N - Numerical Aptitude	109.9	12.6	73-144	.518*
S - Spatial Aptitude	115.4	18.3	69-166	.465*
P - Form Perception	111.0	15.5	45-146	.315
Q - Clerical Perception	107.9	12.7	77-139	.442*
K - Motor Coordination	107.1	17.6	31-140	.242
F - Finger Dexterity	104.6	19.6	27-142	.311
M - Manual Dexterity	116.4	19.4	68-149	.514*

D. GENERAL LABOR WORKER N = 61

Aptitude	Mean	SD	Range	r_{bis}
G - General Learning Ability	100.4	13.5	78-143	.468*
V - Verbal Aptitude	94.4	10.4	78-129	.444*
N - Numerical Aptitude	103.5	18.0	63-141	.467*
S - Spatial Aptitude	101.2	15.9	68-150	.216
P - Form Perception	107.1	15.7	67-141	.605*
Q - Clerical Perception	102.5	15.7	61-153	.582*
K - Motor Coordination	106.5	16.0	76-148	.524*
F - Finger Dexterity	94.5	17.2	49-147	.348*
M - Manual Dexterity	113.0	16.6	77-149	.520*

*Significant (Correlation more than twice the standard error.)

E(1). INGOT MOLD FOUNDRY JOBS VALIDATION SAMPLE N = 71

Aptitude	Mean	SD	Range	r_{bis}
G - General Learning Ability	103.2	11.2	76-134	.024
V - Verbal Aptitude	97.4	10.4	66-123	-.200
N - Numerical Aptitude	103.4	12.8	76-144	.092
S - Spatial Aptitude	105.4	17.5	74-166	.004
P - Form Perception	109.8	15.2	78-147	.251
Q - Clerical Perception	104.4	12.9	79-144	.041
K - Motor Coordination	107.0	14.4	80-151	.108
F - Finger Dexterity	98.2	16.1	63-135	-.064
M - Manual Dexterity	112.5	20.5	66-162	.252

E(2). INGOT MOLD FOUNDRY JOBS CROSS-VALIDATION SAMPLE N = 73

Aptitude	Mean	SD	Range	r_{bis}
G - General Learning Ability	100.8	10.3	78-122	.040
V - Verbal Aptitude	92.8	9.0	76-119	-.016
N - Numerical Aptitude	103.9	13.0	71-147	.059
S - Spatial Aptitude	105.1	17.7	61-147	.114
P - Form Perception	108.1	17.7	65-143	.175
Q - Clerical Perception	101.3	12.1	77-131	.135
K - Motor Coordination	108.9	16.8	68-149	.309*
F - Finger Dexterity	95.6	17.9	37-135	.274
M - Manual Dexterity	116.5	20.9	65-156	.483*

F. MOLDER, BENCH AND MOLDER, FLOOR N = 54

Aptitude	Mean	SD	Range	r_{bis}
G - General Learning Ability	102.3	11.0	76-127	.347*
V - Verbal Aptitude	97.5	9.2	82-121	.296
N - Numerical Aptitude	106.0	11.9	71-128	.379*
S - Spatial Aptitude	101.0	14.4	71-140	.311
P - Form Perception	107.7	14.2	81-142	.450*
Q - Clerical Perception	101.4	11.3	79-139	.425*
K - Motor Coordination	106.7	16.7	64-144	.240
F - Finger Dexterity	95.0	15.6	64-132	.239
M - Manual Dexterity	113.3	19.3	74-153	.055

*Significant (Correlation more than twice the standard error.)

G. ROLLING MILLS JOBS N = 70

Aptitude	Mean	SD	Range	r_{bis}
G - General Learning Ability	107.3	12.0	82-142	.078
V - Verbal Ability	100.7	12.0	68-135	.005
N - Numerical Aptitude	105.9	14.5	60-149	.184
S - Spatial Aptitude	108.6	15.0	78-140	-.121
p - Form Perception	110.6	14.6	85-160	.418*
Q - Clerical Perception	106.1	14.9	78-147	.349*
K - Motor Coordination	108.9	16.7	68-157	.237
F - Finger Dexterity	97.9	21.6	64-142	.114
M - Manual Dexterity	113.7	18.4	68-159	.367*

H(1). STRUCTURAL-SHIPPING YARD JOBS, VALIDATION SAMPLE N = 82

Aptitude	Mean	SD	Range	r_{bis}
G - General Learning Ability	106.7	9.8	88-132	.398*
V - Verbal Ability	99.6	9.8	80-127	.082
N - Numerical Aptitude	107.0	11.8	86-135	.376*
S - Spatial Aptitude	108.7	14.4	81-150	.352*
P - Form Perception	107.9	13.4	57-138	.280*
Q - Clerical Perception	105.4	10.7	72-133	.371*
K - Motor Coordination	108.9	13.9	76-140	.341*
F - Finger Dexterity	98.3	17.5	52-141	.213
M - Manual Dexterity	115.6	16.2	77-153	.368*

H(2). STRUCTURAL-SHIPPING YARD JOBS, CROSS-VALIDATION SAMPLE N = 86

Aptitude	Mean	SD	Range	r_{bis}
G - General Learning Ability	106.3	11.0	55-137	.330*
V - Verbal Ability	98.4	11.0	76-129	.241
N - Numerical Aptitude	107.3	11.6	55-142	.231
S - Spatial Aptitude	108.0	15.4	71-150	.162
P - Form Perception	111.7	15.7	69-150	.205
Q - Clerical Perception	107.9	13.4	77-151	.222
K - Motor Coordination	106.8	17.2	73-159	.321*
F - Finger Dexterity	101.2	17.1	52-141	-.042
M - Manual Dexterity	112.4	18.9	75-166	.401*

*Significant (Correlation more than twice the standard error.)

TABLE 5

Summary of Qualitative and Quantitative Data

A. SECOND HELPER-OPEN HEARTH

Type of Evidence	Aptitudes								
	G	V	N	S	P	Q	K	F	M
Job Analysis Data									
Important	X		X	X	X		X		X
Irrelevant		0				0			
Relatively High Mean				X	X		X		X
Relatively Low Standard Dev.	X	X			X	X			
Significant Correlation with Criterion					X				
Aptitudes to be Considered for Trial Norms	G			S	P		K		M

B. BILLET YARD JOBS

Type of Evidence	Aptitudes								
	G	V	N	S	P	Q	K	F	M
Job Analysis Data									
Important				X	X		X		X
Irrelevant		0				0			
Relatively High Mean					X		X		X
Relatively Low Standard Dev.	X	X	X			X			
Significant Correlation with Criterion	X		X	X	X	X	X		X
Aptitudes to be Considered for Trial Norms	G		N	S	P		K		M

C. MAINTENANCE MAN, FACTORY OR MILL

Type of Evidence	Aptitudes								
	G	V	N	S	P	Q	K	F	M
Job Analysis Data									
Important	X			X	X		X	X	X
Irrelevant		0							
Relatively High Mean	X			X					X
Relatively Low Standard Dev.	X	X	X			X			
Significant Correlation with Criterion	X	X	X	X		X			X
Aptitudes to be Considered for Trial Norms	G		N	S		Q			M

D. GENERAL LABOR WORKER

Type of Evidence	Aptitudes								
	G	V	N	S	P	Q	K	F	M
Job Analysis Data									
Important				X	X		X		X
Irrelevant		0				0			
Relatively High Mean					X		X		X
Relatively Low Standard Dev.	X	X							
Significant Correlation with Criterion	X	X	X		X	X	X	X	X
Aptitudes to be Considered for Trial Norms	G		N		P		K	F	M

E(1). INGOT MOLD FOUNDRY JOBS (VALIDATION SAMPLE)

Type of Evidence	Aptitudes								
	G	V	N	S	P	Q	K	F	M
Job Analysis Data									
Important	X		X		X		X		X
Irrelevant		0				0			
Relatively High Mean					X		X		X
Relatively Low Standard Dev.	X	X	X			X			
Significant Correlation with Criterion									
Aptitudes to be Considered for Trial Norms	G		N		P		K		M

E(2). INGOT MOLD FOUNDRY JOBS (CROSS-VALIDATION SAMPLE)

Type of Evidence	Aptitudes								
	G	V	N	S	P	Q	K	F	M
Job Analysis Data									
Important	X		X		X		X		X
Irrelevant		0				0			
Relatively High Mean					X		X		X
Relatively Low Standard Dev.	X	X	X			X			
Significant Correlation with Criterion							X		X
Aptitudes to be Considered for Trial Norms	G		N		P		K		M

F. MOLDER, BENCH AND MOLDER, FLOOR

Type of Evidence	Aptitudes								
	G	V	N	S	P	Q	K	F	M
Job Analysis Data									
Important	X			X	X		X		X
Irrelevant		0				0			
Relatively High Mean			X		X		X		X
Relatively Low Standard Dev.	X	X	X			X			
Significant Correlation with Criterion	X		X		X	X			
Aptitudes to be Considered for Trial Norms	G		N		P		K		M

G. ROLLING MILLS JOBS

Type of Evidence	Aptitudes								
	G	V	N	S	P	Q	K	F	M
Job Analysis Data									
Important	X			X	X		X		X
Irrelevant		0				0			
Relatively High Mean				X	X		X		X
Relatively Low Standard Dev.	X	X	X		X				
Significant Correlation with Criterion					X	X			X
Aptitudes to be Considered for Trial Norms	G			S	P		K		M

H(1). STRUCTURAL-SHIPPING YARD JOBS (VALIDATION SAMPLE)

Type of Evidence	Aptitudes								
	G	V	N	S	P	Q	K	F	M
Job Analysis Data									
Important	X		X	X	X	X	X		X
Irrelevant		0							
Relatively High Mean			X	X	X		X		X
Relatively Low Standard Dev.	X	X	X			X			
Significant Correlation with Criterion	X		X	X	X	X	X		X
Aptitudes to be Considered for Trial Norms	G		N	S	P	Q	K		M

H(2). STRUCTURAL-SHIPPING YARD JOBS (CROSS-VALIDATION SAMPLE)

Type of Evidence	Aptitudes								
	G	V	N	S	P	Q	K	F	M
Job Analysis Data									
Important	X		X	X	X	X	X		X
Irrelevant		0							
Relatively High Mean			X	X	X	X			X
Relatively Low Standard Dev.	X	X	X			X			
Significant Correlation with Criterion	X						X		X
Aptitudes to be Considered for Trial Norms	G		N	S	P	Q	K		M

DERIVATION AND VALIDITY OF NORMS

Final norms were derived on the basis of a comparison of the degree to which trial norms consisting of various combinations of the aptitudes shown in the bottom lines of Table 5 at trial cutting scores were able to differentiate between the percentage of the sample rated as good workers and the percentage rated as poor workers. Trial cutting scores at five point intervals approximately one standard deviation below the mean are tried because this will eliminate about one third of the sample with three-aptitude norms. For four-aptitude trial norms, cutting scores of slightly less than one standard deviation below the mean will eliminate about one third of the sample; for two-aptitude trial norms, cutting scores of slightly more than one standard deviation below the mean will eliminate about one third of the sample. The Phi Coefficient was used as a basis for comparing trial norms. The norms which provided the highest degree of differentiation for the various jobs and job areas and the validity of these norms is shown in Table 6. The validity of the norms for Ingot Mold Foundry Jobs and Structural Shipping Yard Jobs when applied to the cross-validation samples is also shown in Table 6.

TABLE 6

Predictive Validity of Test Norms

A. SECOND HELPER-OPEN HEARTH
(P-95, K-80, M-90)

	Nonqualifying Test Scores	Qualifying Test Scores	Total
Good Workers	9	33	42
Poor Workers	9	4	13
Total	18	37	55

Phi Coefficient (ϕ) = .43 Chi Square (X^2) = 10.28
Significance Level = $P/2 < .005$

B. BILLET YARD JOBS
(P-105, M-95)

	Nonqualifying Test Scores	Qualifying Test Scores	Total
Good Workers	12	46	58
Poor Workers	15	7	22
Total	27	53	80

Phi Coefficient (ϕ) = .45 Chi Square (X^2) = 16.08
Significance Level = $P/2 < .0005$

C. MAINTENANCE MAN, FACTORY OR MILL
(G-105, N-90, M-90)

	Nonqualifying Test Scores	Qualifying Test Scores	Total
Good Workers	1	35	36
Poor Workers	14	3	17
Total	15	38	53

Phi Coefficient (ϕ) = .83 Chi Square (X^2) = 36.09
Significance Level = P/2 < .0005

D. GENERAL LABOR WORKER
(P-95, F-75, M-85)

	Nonqualifying Test Scores	Qualifying Test Scores	Total
Good Workers	4	38	42
Poor Workers	13	6	19
Total	17	44	61

Phi Coefficient (ϕ) = .61 Chi Square (X^2) = 22.57
Significance Level = P/2 < .0005

E(1). INGOT MOLD FOUNDRY JOBS (VALIDATION SAMPLE)
(P-90, K-85, M-100)

	Nonqualifying Test Scores	Qualifying Test Scores	Total
Good Workers	13	37	50
Poor Workers	10	11	21
Total	23	48	71

Phi Coefficient (ϕ) = .21 Chi Square (X^2) = 3.12
Significance Level = P/2 < .05

E(2). INGOT MOLD FOUNDRY JOBS (CROSS-VALIDATION SAMPLE)
(P-90, K-85, M-100)

	Nonqualifying Test Scores	Qualifying Test Scores	Total
Good Workers	15	36	51
Poor Workers	12	10	22
Total	27	46	73

Phi Coefficient (ϕ) = .24 Chi Square (X^2) = 4.16
Significance Level = P/2 < .025

F. MOLDER, BENCH AND MOLDER, FLOOR
(N-90, P-100, M-85)

	Nonqualifying Test Scores	Qualifying Test Scores	Total
Good Workers	5	30	35
Poor Workers	12	7	19
Total	17	37	54

Phi Coefficient (ϕ) = .50 Chi Square (X^2) = 13.61
Significance Level = P/2 < .005

G. ROLLING MILLS JOBS
(P-95, K-80, M-105)

	Nonqualifying Test Scores	Qualifying Test Scores	Total
Good Workers	10	36	46
Poor Workers	15	9	24
Total	25	45	70

Phi Coefficient (ϕ) = .40 Chi Square (X^2) = 11.41
Significance Level = P/2 < .0005

H(1). STRUCTURAL-SHIPPING YARD JOBS (VALIDATION SAMPLE)
(N-90, Q-100, M-95)

	Nonqualifying Test Scores	Qualifying Test Scores	Total
Good Workers	13	41	54
Poor Workers	16	12	28
Total	29	53	82

Phi Coefficient (ϕ) = .33 Chi Square (X^2) = 8.86
Significance Level = P/2 < .005

H(2). STRUCTURAL-SHIPPING YARD JOBS (CROSS-VALIDATION SAMPLE)
(N-90, Q-100, M-95)

	Nonqualifying Test Scores	Qualifying Test Scores	Total
Good Workers	17	40	57
Poor Workers	18	11	29
Total	35	51	86

Phi Coefficient (ϕ) = .31 Chi Square (X^2) = 8.26
Significance Level = P/2 < .005

DETERMINATION OF OCCUPATIONAL APTITUDE PATTERNS

The data for three of these studies met the requirements for incorporating the occupations studied into OAP-30 which is shown in Section II of the Guide to the Use of the General Aptitude Test Battery. The OAP-30 norms of P-85, K-85, M-100 yield Phi Coefficients of .18 with the data for Second Helper-Open Hearth, .23 with the data on Ingot Mold Foundry Jobs and .41 with the data on Rolling Mills Jobs.

In addition, the data for General Labor Worker met the requirements for incorporating the occupation studied into OAP-29, also shown in Section II. A Phi Coefficient of .35 is obtained on the General Labor Worker data with the OAP-29 norms of P-90, F-85,, M-75.

The data for the other four occupations did not meet the requirements for incorporating the occupations studied into any of the 36 OAP's included in the current Section II structure. The data for these occupations will be considered for future groupings of occupations in the development of new occupational aptitude patterns.

November 1965 S-356

FACT SHEET

Job Title: Second Helper-Open Hearth (iron & steel) 512.884-010

Department Description: Workers in this department are responsible for the production of steel in open hearths, in which molten pig iron is mixed with other raw materials to produce various grades of steel. Workers are expected to learn and perform the duties of Second Helper, with potential to advance to First Helper and thereby assume total responsibility for the entire hearth.

Work Performed: Assists the First Helper in charging the hearth, in which scrap metal and alloys such as manganese, nickel and titanium are pushed through an open door of the furnace by a charging machine. Regulates furnace heat to control temperature of molten heat by checking gauges, and assists in adding materials or fuels to raise or lower temperature. Secures alloy materials required for tapping the hearth from bins and shovels load into wheelbarrow to tote boxes in front of open hearth and unloads materials. Shovels material into open hearth when directed by First Helper.

When molten metal is ready for tapping, digs out a taphole in the spout of the open hearth by using a small bar to remove loam material. Scrapes all loam material carefully from around a tube (approximately 6 feet long) through which the molten metal will run. Using tongs, places a jet tapper (a small electrically detonated explosive) inside the taphole. Insures that the tapper is properly placed to avoid incorrect blast when tapper is electrically detonated by the melter.

After molten metal has been drained from furnace, mixes loam material to proper consistency and with trowel closes taphole. Cleans the tapping spout and relines it with fresh loam. When trough has been removed from the spout by crane, cleans and relines trough with fresh loam using a shovel and trowel. Reseals the joint where the trough meets the spout with additional loam.

Effectiveness of Norms: Only 76% of the nontest-selected workers used in this study were good workers; if the workers had been test-selected with the S-356 norms, 89% would have been good worker. 24% of the nontest-selected workers used in this study were poor workers; if the workers had been test-selected with the S-356 norms, only 11% would have been poor workers.

Applicablity of S-356 Norms: The aptitude test battery is applicable to jobs which include a majority of duties described above.

March 1966

S-362

FACT SHEET

Job Titles:

Billet Yard Jobs (iron & steel)

Typical Jobs:

Pickler (iron & steel) 503.885-037
Scarfer (iron & steel) 816.884-022
Chipper (iron & steel) 705.884-020

As this battery was developed on workers expected to perform these jobs and several additional ones, the norms may not be appropriate for use with applicants expected to perform only one of these jobs.

Department Description: Operation in this department consists of conditioning, preparing and materials handling, by grade size semi-finished rolled and forged alloy steel products. Workers are expected to perform at a zone level represented by the three jobs described below.

Work Performed on Typical Jobs:

Pickler

Removes scale and dirt from steel products by immersion in sulphuric acid bath.

Inspects chains used in pickling. Identifies each piece of steel on printed form and places designated pieces in acid bath using chain sling. Tests acid with hydrometer and turns valve to add acid from storage tank. When steel is properly pickled, removes steel from tank and positions in cold water rinse tank to be sent to temporary storage. Repaints identification marks on steel using brush and white paint.

Scarfer

Removes surface defects from steel products with hand scarfing touch (oxygen-acetylene hand torch).

Obtains protective equipment and torch for storage room. Connects and disconnects torch to oxygen and acetylene hoses. Ignites torch; regulates combustible mixture and directs the flame along materials surface to remove defects. Scrapes and removes oxydized scale from scarfed materials with hand scraper and compressed air hose.

Chipper

Removes surface defects from steel products with a chipping hammer and chisels: Connects hand chipping hammer to air hose and inserts chisels; receives instructions as to type of defect and the degree to which defects are to be removed; operates and guides hammer to chip out defects; lubricates hammer when necessary; turns material with a turning bar or by the assistance of an overhead crane for chipping and inspection purposes; performs crane hooking when working with others to remove and replace stock on conditioning beds; uses light hand tools in cleaning working area.

Effectiveness of Norms:

Only 68% of the nontest-selected workers used in this study were good workers; if the workers had been test-selected with the S-362 norms, 87% would have been good workers. 32% of the nontest-selected workers used in this study were poor workers; if the workers had been test selected with the S-362 norms, only 13% would have been poor workers.

Applicability of S-362 Norms:

The aptitude test battery is applicable to jobs which include a majority of duties described above.

March 1966 S-363

FACT SHEET

Job Title: Maintenance Man, Factory or Mill (any ind.) 899.281-018

Department Description: Workers in this department provide repair service on the highest craft level for machinery and equipment used in the following areas: open hearths, rolling mills, bridge cranes, heating furnaces, soaking pits, stationary steam engines.

Work Performed:

Electrical Repairing

Installs, maintains and repairs electrical and mechanical equipment and electrically operated equipment on specific assigned jobs.

Inspects motors, generators, switchboards, and auxiliary equipment for operating conditions; interprets drawings; shoots trouble on wiring circuits using testing equipment.

Selects tools; repairs parts and equipment for job.

Uses hand tools such as wrenches, pliers, hammers, screwdrivers; uses lifting equipment, etc. to dismantle equipment and replace defective parts such as armatures, fields, shafts, bearings, contacts, brushes, etc.

Repairs and renews wiring on switchboards, control boards, control units; replaces relays, switches, signal lights, etc.

Makes emergency repairs to power lines; wires motor starters; replaces fuses, lamps, sockets, etc.

Lubricates shafts, motors, etc. and cleans equipment.

Makes mechanical repairs to electrical equipment such as removing, dismantling, repairing, assembling and replacing crane wheels, shafting, blocks, cables, etc.

Checks and adjusts operation of equipment on completion of repairs. May use burning torch to burn plates, bolts, conduit, etc.

Mechanical Repairing

Installs, maintains and repairs mechanical equipment in the Structural Shipping Yard.

Inspects equipment; plans working procedures, referring as necessary to prints, sketches, etc.

Selects tools; repairs parts and equipment as necessary.

Uses hand tools, powered hand tools, lifting equipment, etc. to dismantle, lubricate, repair and install mechanical equipment such as cold saws, gags, shears, roller lines, tilters, cranes, etc.

Removes and replaces worn or broken gears, shafts, bearings, pins, pulleys, etc.

Uses measuring tools to measure and mark off material for fabrication or assembly.

Constructs platforms and storage skids, performs necessary layout and burning of structural steel.

Melts babbitt and pours into bearing boxes rigged with suitable core.

Repairs tools such as chipping hammers, grinders, etc.

Effectiveness of Norms:

Only 68% of the nontest-selected workers used in this study were good workers; if the workers had been test-selected with the S-363 norms, 92% would have been good workers. 32% of the nontest-selected workers used in this study were poor workers; if the workers had been test-selected with the S-363 norms, only 8% would have been poor workers.

Applicability of S-363 Norms:

The aptitude test battery is applicable to jobs which include a majority of duties described above.

March 1966 S-364

FACT SHEET

Job Title:

General Labor Worker (iron & steel) 899.887-012

Department Description: Workers in this department perform general labor work throughout the plant especially to unload plant supplies and raw materials; tear out and remove old brickwork in furnace and ovens; provide for general plant cleanliness and control of vegetation; excavate for new and replacement construction projects and pour concrete required for foundation, floors, etc.

Work Performed:

Performs crane hooking to load, unload and handle various materials.

Excavates foundations using pick, shovel, powered hand tools such as paving breaker, jackhammer and mobile equipment as necessary, back filling as required and disposes of debris by shoveling into car or truck.

Pours ready mix or grout; mixes concrete or grouting by hand; wheels in buggies to job; pours and works concrete.

Cleans sumps and valve pits using shovels, bucket and hand or powered winches.

Maintains general cleanliness in yard areas, mows grass, etc.

Removes snow and ice from crossings, switches, walkways, etc. as required using pick, shovel, broom and assists in loading using mechanical equipment.

Strips forms from concrete foundations using bar, hammer, pick, etc.; piles and disposes of lumber.

Operates air or electric powered winch and positions various types of materials such as structural steel, roofing material, etc.

Directs and works with others to clean working area using broom, shovel, etc. during progress and after completion of job.

Cleans and scrapes roofs using broom, shovel, scraper, pneumatic chipper, etc.

Prepares site for blasting using mat, ties, etc. and in policing area; works under supervision to place charge, hook up and test equipment.

Loads and unloads various cars and trucks.

Effectiveness of Norms:

Only 69% of the nontest-selected workers used in this study were good workers; if the workers had been test-selected with the S-364 norms, 86% would have been good workers. 31% of the nontest-selected workers used in this study were poor workers; if the workers had been test-selected with the S-364 norms, only 14% would have been poor workers.

Applicability of S-364 Norms:

The aptitude test battery is applicable to jobs which include a majority of duties described above.

March 1966 S-365

FACT SHEET

Job Titles:

Ingot Mold Foundry Jobs (found.)

Typical Jobs:

Hand Rammer (found.) 518.381-020
Sand-Slinger Operator (found.) 518.883-010
Knockoutman (found.) 519.887-024

As this battery was developed on workers expected to perform these jobs and several additional ones, the norms may not be appropriate for use with applicants expected to perform only one of these jobs.

Department Description: Workers produce ingot molds for use in other departments. The mold cavity is made by ramming sand by hand or machine around a pattern in a container or flask so that ultimately molten metal may be poured into a cavity to produce a casting.

Work Performed on Typical Jobs:

Hand Rammer

Selects proper pattern, spindle, core box, bottom plates, flasks, etc.

Performs preparatory operations such as setting up and clay washing spindles, ramming and leveling bottom plate and positioning stripping boards.

Using a pneumatic ramming tool, rams sand between pattern and flask and between spindle and core box; directs Helper to shovel sand as required and position vent rods and loose pattern pieces.

Signals Craneman and performs crane hooking to strip pattern from rammed check (the part forming the side walls of the mold) and remove core box after clamps have been loosened; transports core (a separate part of the mold used to create openings in a casting) from ramming pit to transfer buggy and the check to finishing stands; places check over core preparatory to oven drying.

Sand-Slinger Operator

Operates electric and hydraulic controls of sand slinging machine regulating travel of machine, height of impeller head and volume of sand.

Observes ramming effect in core or mold as impeller head forces molding sand between flask and pattern or between pit wall and pattern.

Sand-Slinger Operator (cont'd)

Disconnects electrical feed cables and signals craneman for transfer of sandslinger from one location to another or connects special electrical travel control to move slinger by power from one location to another.

Uses wrench to remove impeller head cover and to replace liner and cups periodically.

Performs various tasks on molding floor or in molding pit such as preparing molds for drying, hammering nails into sand molds, slicking mold surfaces, assisting in patching molds, applying wash, etc.

Obtains tools and equipment and prepares materials for general molding operations.

Assists in setting pattern, placing gaggers, rods, etc. as directed by the molder or other supervision.

Performs crane hooking as required to lift flasks, pattern equipment, etc.

Returns tools and equipment to storage and maintains cleanliness of machine and work.

Knockoutman

Removes flask (container) from the complete mold with a steel bar.

Uses hand-controlled chiseling equipment to clean materials (sand) from interior and exterior of flask.

Effectiveness of Norms:

Only 70% of the nontest-selected workers used for this study were good workers; if the workers had been test-selected with the S-365 norms, 77% would have been good workers. 30% of the nontest-selected workers used for this study were poor workers; if the workers had been test-selected with the S-365 norms, only 23% would have been poor workers. (Validation sample)

Only 70% of the nontest-selected workers used for this study were good workers; if the workers had been test-selected with the S-365 norms, 78% would have been good workers. 30% of the nontest-selected workers used for this study were poor workers; if the workers had been test-selected with the S-365 norms, only 22% would have been poor workers. (Cross-validation sample)

Applicability of S-365 Norms:

The aptitude test battery is applicable to jobs which include a majority of duties described above.

March 1966 S-366

FACT SHEET

Job Titles:

Molder, Bench (conc. prod.; found.) 518.381-022
Molder, Floor (found.) 518.381-022

Department Description: Workers prepare castings that include a wide diversity of items such as piping, forge doors, furnace covers, rolling mill equipment, etc.

Work Performed:

Performs pit, floor and bench molding of an apprenticeable craft nature using green sand, loam or dry sand; closes molds and directs the pouring of molten metal.

Receives print, pattern and general instruction as to molding requirements; checks and inspects pattern to determine work procedure.

Directs and works with assigned crew in preparing work area, placing bottom plates, flasks, pattern, etc., and in procuring reinforcement materials.

In loam molding, lays bricks to form the shape of casting with loam sand used as mortar.

Places necessary reinforcements such as gaggers, rods, flask pieces and brick in position; shovels or directs shoveling of heap sand; uses pneumatic rammer to ram sand to proper density.

Places cores and closes mold using hand tools to tighten nuts, bolts, drive wedger, etc.

Pours and/or directs crew in pouring molten metal.

Effectiveness of Norms:

Only 65% of the nontest-selected workers used in this study were good workers; if the workers had been test-selected with the S-366 norms, 81% would have been good workers. 35% of the nontest-selected workers used in this study were poor workers; if the workers had been test-selected with the S-366 norms, only 19% would have been poor workers.

Applicability of S-366 Norms:

The aptitude test battery is applicable to jobs which include a majority of duties described above.

March 1966 S-367

FACT SHEET

Job Titles:

Rolling Mills Jobs (iron & steel)

Typical Jobs:

Guide Setter (iron & steel) 613.381-010
Manipulator (iron & steel) 613.782-030
Screwdown Operator (iron & steel) 613.782-070

As this battery was developed on workers expected to perform these jobs and several additional ones, the norms may not be appropriate for use with applicants expected to perform only one of these jobs.

Department Description: Workers in this department observe the rolling process; operate various manual and electronic controls and switches; set up and adjust roll guides to align material for entry into rolling machine.

Work Performed on Typical Jobs:

Guide Setter

Keeps mill guides in adjustment during rolling operation.

Works in dismantling, assembling and installing mill guides on various mill stands.

Observes material during rolling process and uses hand tools in adjusting guides to produce a product meeting specifications.

Selects guides, rest bars and other equipment and uses hand tools to install guides between main and supplementary mills; determines the need for any adjustments to guides during the rolling process.

Stores equipment in orderly arrangement, checking and maintaining condition of equipment and reporting need of replacements.

Works with crew during roll changes, using heavy hand tools and cleaning the work area.

Manipulator

Operates the fingers and sideguards to turn and align material for entry into the roll passes:

Operates the manipulator to turn over material and the sideguards to align material for entry into proper roll pass.

Uses medium weight hand tools such as sledge, wrenches, etc, in working with assigned crew on roll changes.

Manipulator (cont'd.)

Performs occasional crane hooking during roll changing operations.

Maintains cleanliness of assigned mill area.

Screwdown Operator

Operates hand levers to control drafts on the main mill.

Works with Roller to check mill.

Marks draft on indicator of main and supplementary mills to serve as guide on the amount of draft to be taken on each pass.

Operates hand levers to control main mill top roll and vertical rolls as necessary for each draft, working closely with Table Operator.

Changes draft at request of Roller or on his own judgment depending on temperature of steel.

Works with crew during roll changes using hand tools, determining crane hooking and cleaning the work area.

Effectiveness of Norms:

Only 66% of the nontest-selected workers used in this study were good workers; if the workers had been test-selected with the S-367 norms, 80% would have been good workers. 34% of the nontest-selected workers used in this study were poor workers; if the workers had been test-selected with the S-367 norms, only 20% would have been poor workers.

Applicability of S-367 Norms:

The aptitude test battery is applicable to jobs which include a majority of duties described above.

March 1966 S-368

FACT SHEET

Job Titles:

Structural-Shipping Yard Jobs

Typical Jobs:

Electric-Bridge-Crane Operator (any ind.) 921.883-050
Crane Follower (any ind.) 892.883-012
Gasoline-Truck Operator (any ind.) 922.883
Gag-Press Straightener (iron & steel) 617.782-036
Slipmaker (iron & steel) 619.387-014

As this battery was developed on workers expected to perform these jobs and several additional ones, the norms may not be appropriate for use with applicants expected to perform only one of these jobs.

Department Description: Workers in this department are basically material handlers of structural steel products that includes the loading of outgoing motor trucks and railroad cars.

Work Performed on Typical Jobs.

Electric-Bridge-Crane Operator

Operates a powered overhead traveling double trolley crane to load structural steel on motor trucks or to pile and transfer structural material within the yard.

Directs helpers to chain material on both ends; manipulates multiple rheostat control levers and foot pedals to control movement of bridge, trolleys and cable blocks.

Exercises extreme caution in operating simultaneously two sets of independent controls which manipulate both ends of the material to be moved.

Observes hand signals carefully as a primary source of communications.

Makes minor repairs to crane with hand tools; performs routine crane lubrication.

Crane Follower

Loads and assembles structural steel order bars for transfer by crane to various locations. Receives order sheets. Directs helper to have railroad cars or trucks moved to designated location. Locates material as indicated on work sheet according to weight, heat number, etc. Performs crane hooking, using extreme caution in proper placement of cable , etc. May operate crane when necessary.

Gasoline-Truck Operator

Operates a large gasoline-driven piece of moving equipment. Determines from orders or other written material the location of materials to be stored or moved. Directs placement of materials in flat bed of equipment. Climbs to seat of equipment which is approximately ten feet above flat bed. Starts, stops and drives equipment from location to location.

Gag-Press Straightener

Operates one or a variety of machines that will straighten or cut structural steel sections. Operates a vertical gag press. Helps transfer materials to machine with crane hooking equipment. Throws switch and manipulates hand controls to govern material in the machine. Repeats process until section is straightened to proper tolerance. May operate circular saw or cold powered shear using similar process.

Slipmaker

Measures, identifies, allocates and records straightened structural material. Directs crew in transferring material after straightening. Uses tape measure and marks the length of all sections with chalk or paint. Keepsrecords of all material. Directs final disposition of material.

Effectiveness of Norms: Only 66% of the nontest-selected workers used for this study were good workers; if the workers had been test-selected with the S-368 norms, 77% would have been good workers. 34% of the nontest-selected workers used for this study were poor workers; if the workers had been test-selected with the S-368 norms, only 23% would have been poor workers. (Validation sample)

Only 66% of the nontest-selected workers used for this study were good workers; if the workers had been test-selected with the S-368 norms, 78% would have been good workers. 34% of the nontest-selected workers used for this study were poor workers; if the workers had been test-selected with the S-368 norms, only 22% would have been poor workers. (Cross-validation sample)

Applicability of S-368 Norms: The aptitude test battery is applicable to jobs which include a majority of duties described above.

GPO 901-491